Artificial Cells – A Brief Description of How It Works

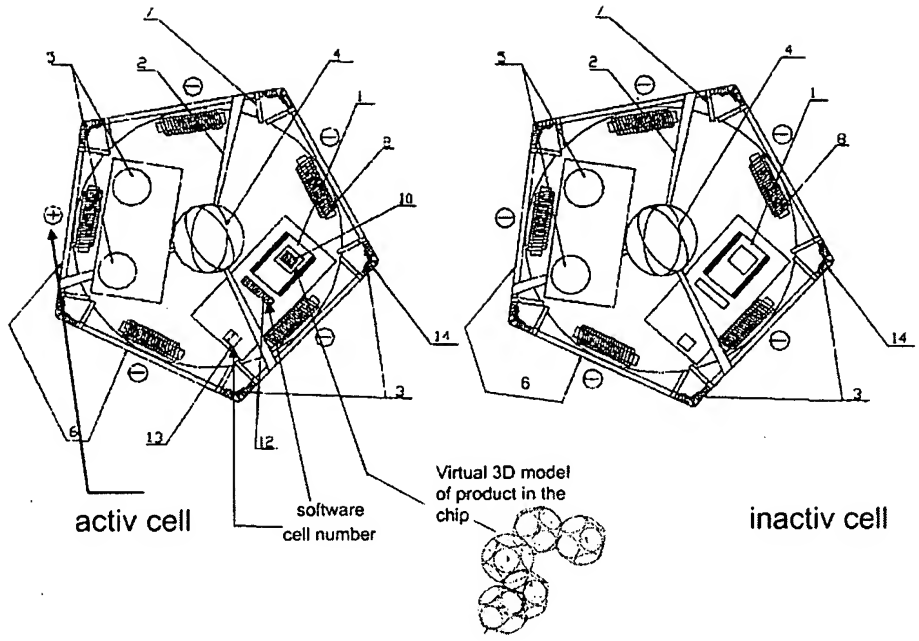
Technology and scale

ArtCell (In Patent Application called A SYSTEM OF THREE-DIMENSIONAL MULTIPURPOSE ELEMENTS) is an artificial cell built with mechano-optoelectronic technology. Using their (**totalling thousands of cells**) self-organised integration it is employed for instant construction of sophisticated 3D usable structures, i.e. manipulating robots, artificial limbs, etc. The dimension of a single item (**at the present available production technologies**) is between 3 – 6 mm as a final product. In five - ten years the forecasted size should be reduced to 0.5- 0.1 - magnitude.

Structure

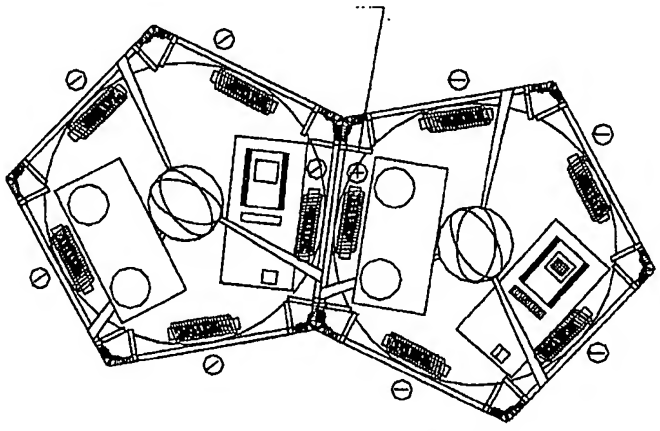
The ArtCell is a spatial object: a solid body (**as prototype I it can be a dodecahedron**), whose all walls are movable as they are interconnected by electroplastic muscules (**electroplastic actuators**[i]). Inside there is a chip with software in it, which controls ArtCell functions using an algorithm (**for prototype I, for prototype II optoelectronic processor is planned**) as well as erasable memory which contains a virtual model of the structure which will be built from the ArtCell (**it is a 3D programmed image of thousands of virtual numbered object cells, which will be reproduced in a real form from the ArtCell**). The ArtCell also has batteries, solar batteries, optical fibre, magnetic anchors and locks (**of mechanical type for prototype I, they can be of chemical type for prototype II**). The ArtCell structure was described in detail in the publication patent no. **US2006155388 (A1) . See also:**
http://v3.espacenet.com/textdoc?DB=EPODOC&IDX=WO2004062759&F=8
Publication
http://v3.espacenet.com/publicationDetails/biblio?CC=EP&NR=1587594&KC=&FT=E
Europe Patent

ArtCell Operation

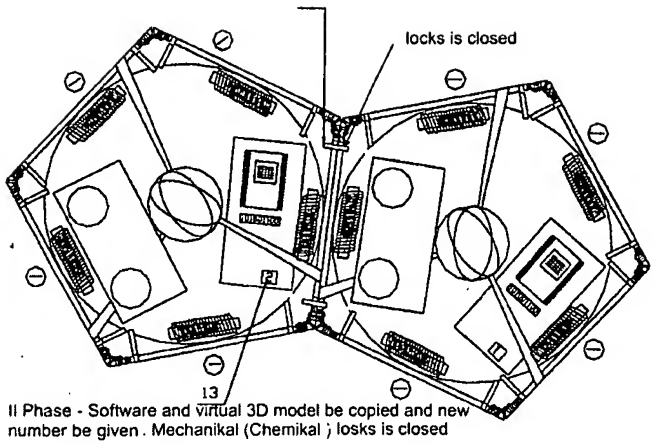


1. When the first ArtCell- 1 (**called active – at least one wall of this cell has a positive polarity**) is put in a moving container, among thousands of other ArtCells (**called inactive – they have all walls with negative polarity**), it will connect immediately to one of the cells.

Links happen first magnetically, and after that with mechanical or chemical locks.

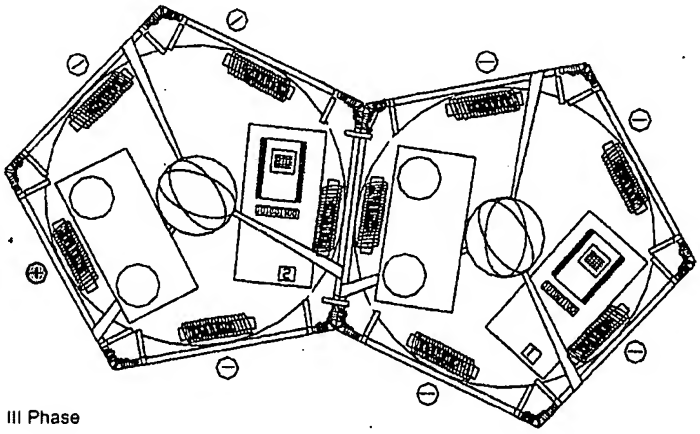


I Phase - Cells are linked together magnetically

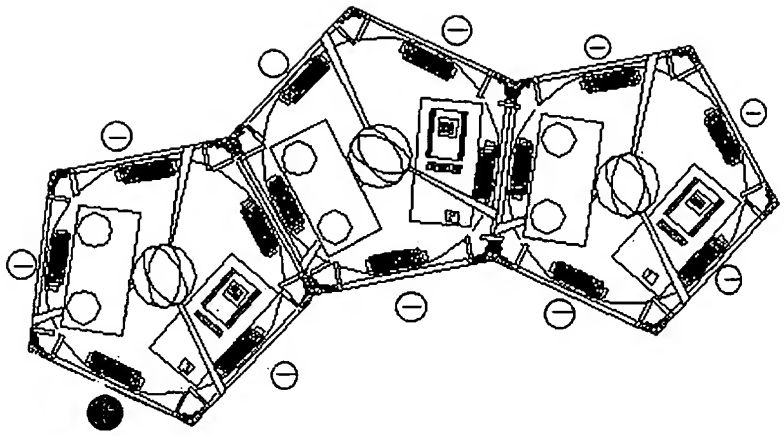


II Phase - Software and virtual 3D model be copied and new number be given . Mechanikal (Chemikal) losks is closed

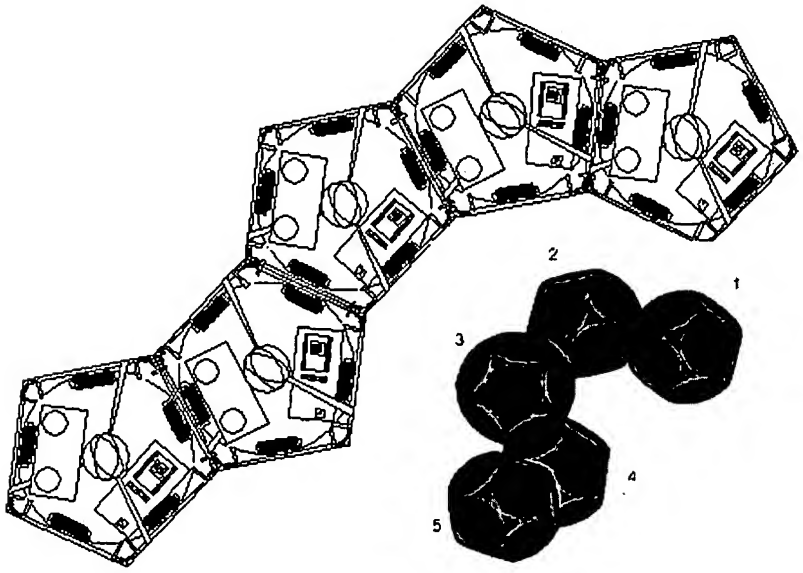
2. Then the software in ArtCell -1 will start copying its own software included in the chip and information about the virtual model included in the memory of the connected neighbouring cell; at the same time the inactive cell is marked as ArtCell -2 (**a phenomenon of information self-copying from one cell to another known from mitosis process in biological cells makes this process quite similar to the one occurring in nature, thus these artificial cells are called MetroGenes by the author**).



III Phase

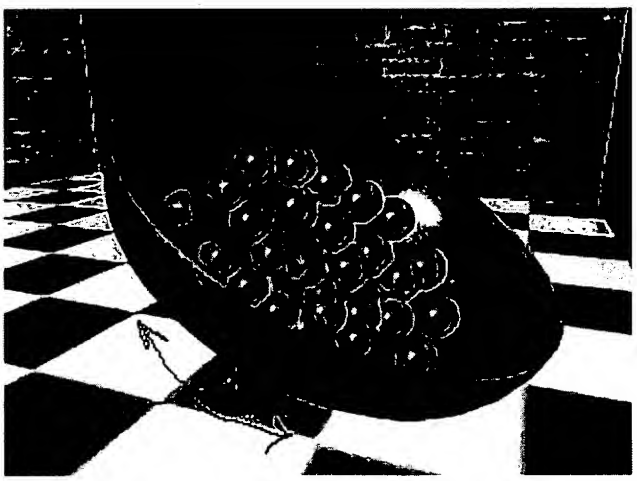


3. By the algorithm for software comparison of the virtual 3D model and the physical state of connection between ArtCell- 1 and ArtCell-2 cells it is determined which of the ArtCell-2 walls is going to be activated (positive polarity) and to which a next ArtCell will be connected, this time described as **number 3.** There, ANALOGUE and DIGITAL technology is used conjunction, **(as examples computer mouse's moving - ANALOGUE SIGNALS and a corresponding mouse's cursor on computers the display, that is it virtually picture, is produced of DIGITAL signals). That everything the become possible is helped of PCL multilayered printed circuits, chip and software as calculates everything)**
And the process can become reverse, digital - virtually signal (INFO) can run it real the product that examples, in the electricity agency, where from the touch-screen is governed to start turbines, pumps, and so on .



Preprogrammed in computer 3D virtual picture (Solid Works , Auto Cad), or LASER

scanned to computer real 3D model, as finished product of self assembling Artificial Cells.



Container with Artificial Cells

4. The process repeats until all numbers in the virtual model are used (of course there must be an adequate number of artificial cells to be used for creating the object in the container).

What can be created using the ArtCell?

Toys – a wide variety of transformed models for children in various age brackets. The period of introduction to the market assuming intensive work on the project: 2-3 years. ArtCells used: several kinds including ones with soft casing.
Size: from 3 to 6 mm

Various designs
Unique body of a car, furniture forms including soft parts of stools, sofas, carpets. Clothes. How are they manufactured? When all demands for construction of a 3D virtual model of these products are fulfilled the process of ArtCell connection occurs automatically. Finished products are subjected to soaking so that all chemical locks are fused and the resulting structure keep the stable and consistent form. The period of introduction to the market assuming intensive work on the project: 3-5 years. ArtCells used: several kinds including ones with soft casing.
Size: from 0.5 to 3 mm

Chemical bond models – for pharmaceutical and chemistry purposes.
The period of introduction to the market assuming intensive work on the project: 2-3 years. Size: from 2 to 6 mm

See and Touch System (3D Videoconference)
Precisely, it is a system which reproduces an original model (the face of an interlocutor) in 3D form which is reproduced 30 times per second (30 frames/sec).

The face of an interlocutor created in this way will have three dimensional features built from ArtCells, which, while self-deforming as new packets of information reach them (**we should remember that the cells have ability of changing its shape because they possess actuators and each of them has a controlling chip inside**) will reproduce full facial movements and gestures.
How does it work? During a 3D videoconference interlocutors' faces are laser scanned about 30 times per second (**a 3D virtual picture of the interlocutor is obtained in this way**) and the data are sent in packets to already created copies of interlocutors' faces in 3D video systems of both partners (**such systems are a moving container with ArtCells described in *ArtCell Operation* part**). As new information about face movements and facial expressions comes, the models of faces in the system are deformed because the ArtCells which constitute interlocutors' faces deform themselves as they are subjected to dynamic changes enforced by new packets of information. In such a conversation the interlocutors can touch their faces feeling intimacy of the partner who can be even at the antipodes or on other planet of the solar system.
The period of introduction to the market assuming intensive work on the project: 5 years. ArtCells used: several kinds including ones with soft casing – skin surface.
Size: from 0.5 to 2 mm

Artificial Limbs
If a proper virtual model of a limb is prepared (**e.g. by a 3D scan of a healthy limb and creation of its mirrored image**) allowing for its natural structure such as skeleton, muscles etc., and determining the proper number of ArtCells as well as their types and varieties (a different type will be used for muscle creation – they will have more complex system of actuators, for a skeleton it will be a stiffer ArtCell wall structure, etc.) the reproduction of 3D copies using ArtCells can be started.
How does it work? The artificial limb created in such a way is controlled by patient's biocurrents and the power is provided by an additional portable source of energy. Thousands of chips which constitute the limb are an enormous computer which simultaneously reproduces movements of the limb as the patient requires it.
The period of introduction to the market assuming intensive work on the project: 3 years. Size: from 1 to 5 mm

Home robots: designed to perform basic activities in a household, cheap, quickly built, intelligent – containing thousands of chips in the cells which constitute them.

Space – multifunction devices – as a device for a particular purpose has been built it can be distributed among individual ArtCells which, in turn, can be used to built another device. It provides mass economy and adaptation ability for new conditions.

Space – interactive characters in See and Touch System – the already described system can be adapted to reproduce a human. Such a model reproduced in conditions of a Mars mission, with voice simulation included and forecasted intelligent behaviour may effectively make up for separation from close relatives and other people during long interplanetary missions. Systems called to

Quasi Teleporting.

Military activities – built as small robots ("Terminators"), to fight against terrorist groups, quickly constructed and deployed to specific areas for particular missions.

[1] More information about electroplasts can be received in publications about Nobel prize laureates who work on plastics with high electrical conductivity and applications of them.

ANNEX – 1

The scope of implementation work for the ready product containing the expenditure of US $ 5 m in 3 year period (an excerpt from the business plan prepared for European conditions)

Stage I – up to 1.5 year – will involve:

building of the ArtCell prototype based on the components available on the market, (**no research or creating of new, before unknown components is stipulated at this stage; the assembly technology will use standard, generally available precision tools**), materials and special work, including construction work. The ArtCell will have max diameter of 20 mm. The materials, components, special operations – plastic, metals and market components such as integrated circuits, memory chips, optical fibres, commissioned software, multilayered printed circuits adjusted for the purpose of the ArtCell, solar batteries, electroplastic actuators, construction work for the entire project including the construction of opto-electronic system for transformation of information and energy. The definition of a preliminary layout of the chip with high degree of integration for the second stage of work. Simultaneous adjustment of known scanning technologies and 3D object laser scanning device which will serve and cooperate with the ArtCell system. Carrying out successful experiments with 20 ArtCells which will lead to its connection into pre-programmed structures, testing of the structure dynamics, tests of component interaction, tests of the ArtCell software; tests of quality and functionality of information packets sent from the scanner to the ArtCells.
The analysis of scanner interaction with ArtCells during the construction of a copied object and the analysis of the movement of a ArtCells group in relation to the previously programmed dynamic 3D model.

Stage II – up to 1.5 year (3 years together with Stage I) will involve:

The start-up of a company test laboratory and construction and technology department. Gradual transfer of knowledge and production of the product to the company area from cooperating institutes and other companies. The commencement of work aimed at the prototype adapted for market purposes. A reduction of ArtCell size to a target size of 3-6 mm. Preparation of a prototype plan for mass production. Preparation of the layout of completely new integrated chip adjusted for the needs of the ArtCell, construction and material implementation of new elements joining ArtCells (locks). Miniaturization of previous ArtCell groups and their adjustment to the technology required in mass production. First

expenditures on the construction of machines capable of manufacturing components as well as complete ArtCells on a mass scale. The beginning of energetic marketing campaign which aims at gaining prospective companies which will financially contribute to the project (public offering considered) and will participate in managing of the company and its strategy. Short test series of mass production of the ArtCell, quality control tests, production equipment tests, final product tests, improving its parameters, elimination of technological and layout deficiencies. Complexity of the product adjusted to the telecommunication market. Creation of service and support department.